

Pressure Mapping

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This is the third slide lecture in a series of eight lectures that are intended to provide an overview of the wheelchair mobility and seating evaluation process. The lecture series contains:

- Seating Biomechanics
- Wheelchair Seat Cushions
- Pressure Mapping
- Wheelchair Backs
- Manual Wheelchair Propulsion Biomechanics
- Rehabilitation Technology Suppliers & Clinicians
- Service Delivery
- Strategies for Effective Documentation

Abstract and Presenter Bio-sketch

- Mark Schmeler is the Director of Clinical Services at the Center for Assistive Technology. He has many years of front-line clinical experience in seating and mobility with individuals with complex seating needs.
- Mary Ellen Buning is a research associate in the Rehabilitation Science and Technology Department with interest in AT education, service delivery and functional outcomes that result from AT devices and services.

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Learning Objectives

- Understand the contribution of pressure mapping to an assessment of pressure distribution in the seated client.
- See the relationship between seated posture and supporting surfaces and comfort, function, prevention of orthopedic deformities and prevention pressure sores.

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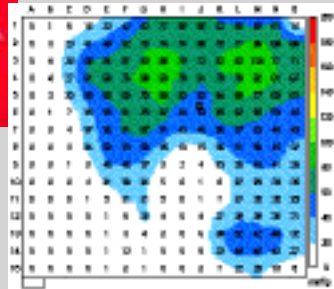
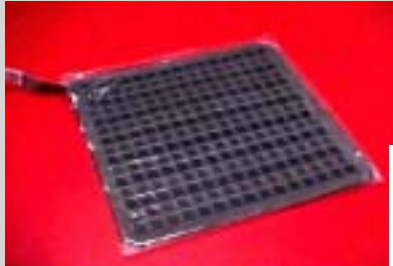
Performance Objectives

- The learner will appreciate the contribution of pressure mapping tools as a part of skilled clinical assessment of the seated posture.
- The learner will understand the pressure management in at-risk clients.

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Pressure Mapping Systems



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Pressure mapping is not used extensively in seating practice. It is a good product when it is used well. It is being used by clinicians, RTS and manufacturers who are using it to support claims for their product. It can be used to support inflated or false claims.

A pressure mapping system is a flat piece of material with sensors that “theoretically” measure pressures. It was developed for researchers who really want to quantify things more than it was developed for clinicians who are trying to make decisions about comfort, pressure ulcers or product differences. Pressure mapping uses sophisticated hardware and software. They cost around \$8000 in addition to the cost of a computer. They are commonly used in Research & Development more than clinically. Also is beginning to be used by HCFA (Healthcare Finance Administration) to categorize cushions. However, pressure mapping is just not good as a single source of verification of the value or application of a cushion.

The numbers on the screen correspond with a pressure reading. Blues are low pressure and reds are high pressures.

What Pressure Mapping Is

- Developed historically for researchers.
- Sophisticated hardware and software.
- Very expensive for clinics to purchase.
- Not yet commonly used in the clinic.
- Becoming more common with suppliers and manufacturers representatives.
- Far less expensive than one flap surgery.

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Most pressure mapping systems are computer based so the cost of the system is in addition to the cost of the computer.

Unfortunately, HCFA is using pressure mapping to rank a cushion and to place in one cost category versus another. The pressure mapping data is being used to make claims about cushions despite the fact that pressure distribution is only one factor in pressure sore prevention.

The Numbers

- Capillary blood flow at the buttocks is around 60mmHg (Bar, 1998).
- Measures the downward vector against gravity only.
- Does not measure shear or contour forces.

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The number that is used as the “gold standard” for optimal pressure (32 mm Hg) is not possible... at least not on earth, maybe on the moon.

The number 32 mm Hg is capillary pressure at heart level. The capillary pressure is much greater than this down by the feet and research by Chris Bar, PhD, shows that 60 mm Hg is probably a much better number to use as capillary pressure.

The pressure mapping systems only measure uniaxial pressure (vertical or straight down) and do not measure shear forces at all.

The literature shows the reliability of pressure mapping is poor. There can be a 20 to 50% margin of error depending on how recently the device was calibrated. Side by side comparison of pressure mapping systems with catheters filled with saline (Team Rehab Report article by Nigel, et al) showed this margin of error.

Clinical Numbers (Shapcott & Levy, 1999)

- 80 mm Hg or less with no reported skin problems.
 - No intervention
- 80-120 mm Hg with uneven pressure distribution.
 - Readjust cushion or try other cushions.
 - Educate clients on pressure relieving techniques.
 - Readjust wheelchair components.

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If the reading are 80 or less do nothing. If they are 80 to 120 there may need to be a change but the intervention may also be to educate the consumer

Sometimes the solution is simply modifying the wheelchair frame by raising the arm rests or raising the foot rests or changing the seat to floor angle..

Clinical Numbers - Cont'd

(Shapcott & Levy, 1999)

- 120-200 mm Hg and uneven peaks
 - Do more detailed investigation
 - Try other types of cushions
 - Discuss pressure relieving techniques
 - Try alternative wheelchair styles (i.e., tilt or recline)

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There is potentially a serious clinical problem ready to develop with numbers in this range.

If the client has a history of pressure ulcers then its also important to look at the whole seating and mobility system, i.e., the wheelchair components, the wheelchair features (i.e., tilt, recline), cushion.

Clinical Applications (Lipka, 1997)

- Objective representation of peak pressure.
- Differential comparison of support surfaces.
- Effectiveness of weight shifting interventions.
- Wheelchair configuration set-up.
- Clinical validation.

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In an American Occupational Therapy Association, Technology SIS newsletter article, Dan Lipka, OTR wrote:

Remember pressure map is only measuring uniaxial pressures.

As will be shown in some slides coming up, the pressure mapping system can provide a dramatic visual demonstration to clients about the effect of weight shifts.

Pressure mapping does allow for before and after comparison rather than product comparison and helps with validating clinical judgement.

Clinical Applications Cont'd

(Lipka, 1997)

- Measure postural abnormality and correction.
- Fabricating custom seating.
- Communication tool with non-verbal clients.
- Documentation and funding.

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A pressure mapping tool can be used to check if a pelvic obliquity has been repaired.

It is a great communication tool for helping clients especially clients with developmental disability. An usual posture or position in a wheelchair is often used by non-verbal clients as a means to relieve pressure/pain.

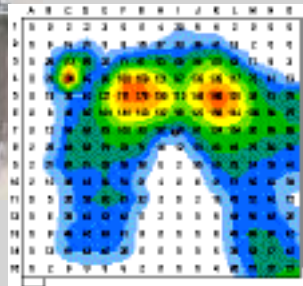
Pressure mapping data can be used to support the recommendation of one cushion or wheelchair feature (tilt vs. recline) over another.

Changing the reimbursement system will help to change the way that seating is paid for in the long term care facilities.

“Bean counters” can show \$ cost numbers but we can’t show \$ benefits numbers yet. Good seating should cut down on staff time spent dealing with patients that are complaining, unhappy and uncomfortable.

Rocking motion can also help with pressure distribution. Several kinds of wheelchairs now have a rocking feature that can be locked out when it is not wanted.

Pressure Mapping as Biofeedback

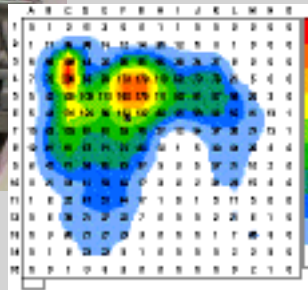
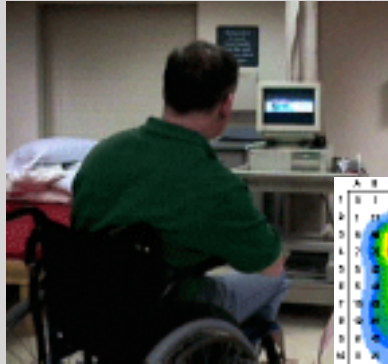


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It gives biofeedback or immediate, clear visual information to the user. It lets the user --especially a new users-- see how shifts in posture can dramatically redistribute pressure. This can help them see the value in "push ups", sideways and forward leans. It also demonstrates the change as a result of tilt or recline.

Shifting to One Side

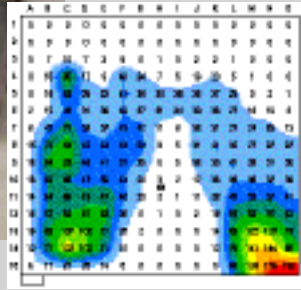
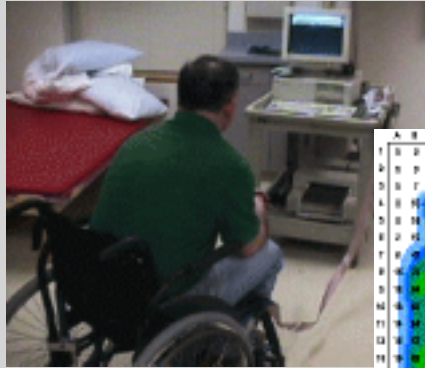


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The image given by this pressure mapping system is inverted or turned around to be interpreted correctly. It is as if you were under the wheelchair and looking upward.

Shifting Forward



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Putting your elbows on your knees off-loads the ischial tuberosities

Important Concepts to Remember

- Pressure alone is not a reliable indicator of risk for skin breakdown.
- Pressure mapping should never replace professional clinical judgement.
- There are performance trade-offs to every type of cushion.

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Pressure is not the only factor in pressure ulcer development. Heat, moisture from perspiration or urine, poor nutrition, sensory loss, age-related connective tissue changes, friction or shear and poor circulation all contribute to pressure ulcers.

Clinical judgement is VERY valuable. This is the same rationale that understands that a positive CAT scan or MRI without other supporting data from history or patient symptom is not an indicator for surgery. Physicians are taught to treat the patient not the X-Ray.

There are trade-offs with every pressure distribution system. Some offer better stability with less pressure distribution so the whole person needs to be taken into consideration.

Remember that a pressure map is still much better than a hand under the patients buttock.

Review Questions

- Why is it important to ask clients about the activities of a “typical day” when conducting a seating assessment?
- Why do some clients have pressure ulcer problems and others do not?
- What is the contribution of wheelchair parts or features to pressure relief?

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Recommended Reading

- Products and Services section of WheelchairNet at:
<http://www.wheelchairnet.org/ProdServ/Products/cushion.html>
- RehabCentral- a WWW resource for clinicians on seating and mobility issues at:
<http://www.rehabcentral.com/>
- Proceedings of the International Seating Symposium & the RESNA Conference at:
<http://www.wheelchairnet.org/WCU/Departments/biblio.html>

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WWW Resources

- The National Pressure Ulcer Advisory Panel: <http://www.npuap.org/>
- A continuing education lesson from the US Pharmacist:
<http://www.uspharmacist.com/NewLook/CE/Ulcers/lesson.htm>

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References

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